Optimization of RLOS protocol for superficial scald prevention on ‘Packham’s Triumph’ pears

Anél Botes

CA meeting – 6 November 2018

Introduction

• What non-chemical technologies are currently available to the South African pear industry:
  - DCA-CF (dynamic controlled atmosphere-chlorophyll fluorescence)
  - DCA-CF + 1-MCP (before packaging)
  - ILOS (initial low oxygen stress) + CA
What is RLOS

- RLOS – repeated cycles of low oxygen stress with ethanol monitoring
- LOS followed by ULO phase
- Ethanol measured after each stress period
- Stress applied every 21 days

### RLOS

#### Stress periods according to RLOS protocol

<table>
<thead>
<tr>
<th></th>
<th>FUJI</th>
<th>RED DELICIOUS</th>
<th>GRANNY</th>
<th>GALA</th>
<th>P.LADY / MODI</th>
<th>MORGEN / R.BEAUTY</th>
<th>CONF / ABATE</th>
<th>PT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O₂ %</td>
<td>CO₂ %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.9</td>
<td>0.1</td>
<td>0.7</td>
<td>0.9</td>
<td>0.5</td>
<td>0.7</td>
<td>0.8</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>0.6</td>
<td>0.7</td>
<td>0.5</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
<td>0.7</td>
<td>0.5</td>
<td>0.7</td>
</tr>
</tbody>
</table>

FCE: Swinglos protocol
RLOS

Maximum level of ethanol suggested in apples and pears during stress periods

<table>
<thead>
<tr>
<th>CULTIVAR</th>
<th>ETHANOL (mg/L juice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braeburn</td>
<td>200-250</td>
</tr>
<tr>
<td>Fuji</td>
<td>70-100</td>
</tr>
<tr>
<td>Gala</td>
<td>50-70</td>
</tr>
<tr>
<td>Golden Delicious</td>
<td>70-100</td>
</tr>
<tr>
<td>Granny Smith</td>
<td>70-100</td>
</tr>
<tr>
<td>Jonagold</td>
<td>50-70</td>
</tr>
<tr>
<td>Morgenduft</td>
<td>70-100</td>
</tr>
<tr>
<td>Pink Lady</td>
<td>50-70</td>
</tr>
<tr>
<td>Red Delicious</td>
<td>300-400</td>
</tr>
<tr>
<td>Packham’s Triumph</td>
<td><strong>100-150</strong></td>
</tr>
</tbody>
</table>

Objectives

• Repeated low oxygen stress (RLOS) can prevent superficial scald on PT during long term storage (10 months)

• Certain seasons the alcohol build-up during stress periods is higher than prescribed maximum of 100-150ppm – off tastes

• Aim
  – to optimize the RLOS protocol to control superficial scald on PT
Materials and Methods

- Optimum harvested PT from Grabouw (2017)
- Treatments
  - RLOS + ULO (0.9% O₂ + 0.8% CO₂)
  - RLOS + CA (1.5% O₂ + 2.5% CO₂)
  - RA
- Storage temperature: -0.5°C
- Storage time:
  - 2 months (min stress period: 1, max stress period: 2)
  - 4 months (min stress period: 1, max stress period: 4)
  - 6 months (min stress period: 1, max stress period: 6)
  - 8 months (min stress period: 1, max stress period: 8)
  - 10 months (min stress period: 1, max stress period: 9)
- 6wk shipping and handling period plus 7 days at 20°C

Results and Discussion

Alcohol concentration (ppm) measured with an alcoholmeter after stress periods

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Stress 1</th>
<th>Stress 2</th>
<th>Stress 3</th>
<th>Stress 4</th>
<th>Stress 5</th>
<th>Stress 6</th>
<th>Stress 7</th>
<th>Stress 8</th>
<th>Stress 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLOS + ULO</td>
<td>195</td>
<td>225</td>
<td>243</td>
<td>403</td>
<td>90</td>
<td>119</td>
<td>99</td>
<td>783</td>
<td>205</td>
</tr>
<tr>
<td>RLOS + CA</td>
<td>72</td>
<td>102</td>
<td>97</td>
<td>37</td>
<td>30</td>
<td>30</td>
<td>37</td>
<td>105</td>
<td>124</td>
</tr>
<tr>
<td>RA</td>
<td>7</td>
<td>10</td>
<td>7</td>
<td>14</td>
<td>6</td>
<td>28</td>
<td>44</td>
<td>27</td>
<td>90</td>
</tr>
</tbody>
</table>
Results and Discussion

Superficial scald development after shelf-life

![Bar chart showing superficial scald development over months for different treatments.]

Results and Discussion

Firmness after shelf-life

![Bar chart showing firmness levels over stress periods for different treatments.]

Source: P<0.0001 StressRegime: <0.0001
LSD,0.05 = 0.16

Number of stress periods
Results and Discussion

Firmness after shelf-life

RLOS + ULO

Stress 1
Stress 3
Stress 5
Stress 7
Stress 9

RLOS + CA
Conclusions

• One stress period of 10 days (0.5-0.6% O₂) was effective to prevent superficial scald over long term storage (10 months)

• High alcohol concentrations after RLOS+ULO did not result in off-tastes

• Alternative if no DCA-CF of DCA-RQ facilities are available

Acknowledgements

• Funders – ARC, HortgroScience
• Howard, Viole and Vanessa for their technical assistance